ECONOMIC COMMENTARY

Chemicals and Petroleum Refining is the Province's largest Manufacturing Sector

December 12, 2016

Highlights:

In 2015, Alberta's chemicals and petroleum refining (CPR) sector had revenues of $26.6 billion, accounting for 39% of total manufacturing revenues. This sector's revenues rose strongly between 2005 and 2014, but are sharply lower in 2015 and 2016 as lower crude oil input prices get reflected in lower prices for refined petroleum products.

Alberta
Government

Overview

Alberta has one of the largest refining and petrochemical industries in Canada, characterized by modern, world-scale plants, efficient transportation systems, and access to the third largest crude oil reserve in the world and significant natural gas reserves. Alberta is home to the largest petroleum refining industry in Canada after overtaking Ontario back in 2011.

In 2015, Alberta's chemicals and petroleum refining (CPR) sector[1] was by far the province's largest manufacturing sector with total revenues of $26.6 billion, accounting for 39% of total manufacturing revenues. Petroleum refining revenues were $14.6 billion and the chemical industry's revenues were $12.0 billion. On a Gross Domestic Product (GDP) basis, this sector's share of manufacturing output was a much lower 22%[2] in 2015 (in constant 2007 dollars). However, even on a GDP basis CPR is the largest manufacturing sector. The CPR sector's contribution to overall Alberta GDP is about 1.3%.

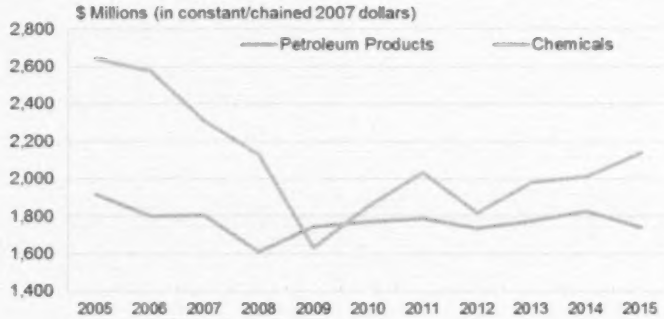
Trends in Output, Revenues, Employment and Investment

The CPR industry is one of Alberta's most volatile industries and has seen sharp declines in revenues in both the Great Recession of 2009 and in the current recession as prices of chemicals and refinery products generally fall sharply during recessions.

Between 2005 and 2015, output volumes of the CPR industry declined by 15%, compared with a 1% drop in GDP for Alberta's manufacturing sector. This 10-year decline was mainly the result of large decreases in the production of fertilizers, such as urea, and of a smaller decline for refinery products such as diesel fuel.

The CPR sector's GDP declined by 26% between 2005 and 2009 as a result of a shortage of ethane feedstock, capacity constraints, the global recession and falling demand for Alberta fertilizers. Output has increased since then, growing by 15% between 2009 and 2015, mainly as a result of a doubling in volumes of synthetic, resins, such as

Chart 1
GDP Trends in the Chemicals and Petroleum Refining Sectors



Source: Statistics Canada

[1] Includes NAICS industries 324 (petroleum and coal products manufacturing) and 325 (chemical manufacturing). About 98% of revenues in industry 324 come from petroleum refineries.

[2] The ratio of GDP to revenues is relatively low for petroleum refining due to the fact that most of that sub-sector's inputs consist of crude oil rather than labour. As a result, CPR's share is much lower for GDP than for revenues.

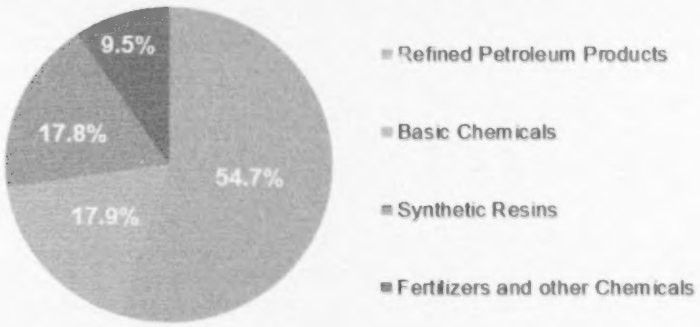
polyethylene and other ethylene polymers, and strong growth in basic chemicals, such as diethylene glycol, propylene, methanol and biodiesel.

Revenues of the CPR industry rose 3% between 2005 and 2015 to $26.6 billion. They increased by 19% between 2005 and 2008 to $30.7 billion, mostly as a result of higher prices for refinery products. The CPR industry's revenues tumbled 28% in 2009, primarily because of lower prices of refinery products and lower volumes of chemicals. Revenues grew by 59% between 2009 and 2014 to a record $35.2 billion as prices of refinery products and volumes of chemical products increased strongly during that period. Revenues fell sharply by 24% in 2015 to $26.6 billion on lower prices for refinery products such as diesel fuel and gasoline.

The industry's largest sub-sectors on a revenue basis are:

- Petroleum products (with products such as diesel fuel and gasoline): $14.6 billion in 2015. Sales increased by 12% between 2005 and 2015: they fell sharply by 28% in 2009; rose 84% between 2009 and 2014; and fell 36% in 2015. Refinery products account for more than 95% of petroleum product sales.
- Basic chemicals (such as styrene and ethylene glycol): $4.8 billion in 2015. Sales declined by 30% between 2005 and 2015: they fell 35% in 2009; grew by 42% between 2009 and 2014; and fell 16% in 2015. Petrochemicals' share of basic chemicals is about 60%.
- Synthetic resins (such as polyethylene): $4.7 billion in 2015. Sales rose 43% between 2005 and 2015: they rose 23% between 2005 and 2008; fell by one-quarter in 2009; rose 39% between 2009 and 2014; and increased 14% in 2015.
- Fertilizers and pesticides: $1.4 billion in 2015. Sales dropped by 28% from 2005: they fell 28% between 2005 and 2008; declined by 36% between 2008 and 2014; and declined by a further 13% in 2015.

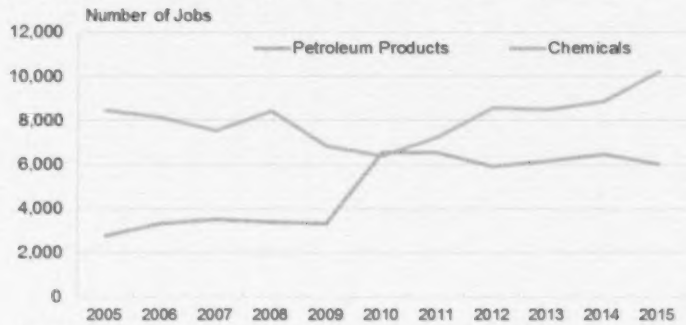
Revenue Shares in 2015 for Major CPR Sub-Sectors



Between 2005 and 2015, the number of employees in the sector rose by 5,020 to 16,260[3], while the value of sales increased by only 3% to $26.6 billion as higher prices more than offset a drop in volumes. The value of sales had increased strongly since the 2009 recession but declined by 24% in 2015 as lower input prices of crude oil were passed on through lower prices for refinery products.

The CPR industry's workforce declined from 11,240 employees in 2005 to 10,150 in 2009 as employment in the basic chemicals sub-sector (mainly petro-chemicals) fell by one-half. However, employment in the industry has risen steadily since 2009 to reach 16,260 in 2015. All CPR sub-sectors increased their employment levels over the 10-year period with the largest increase registered in petroleum refineries.

Chart 2
Employment Trends in the Chemicals and Petroleum Refining Sectors



Source: Statistics Canada

The CPR sector includes 295 business establishments with employees, of which 17% have more than 50 employees. Of these 295 establishments 236 are part of the chemicals sector and 59 of the refined petroleum sector. About 83% of the number of CPR businesses is categorized as being small (less than 50 employees).

The CPR sector invested about $11 billion in Alberta between 2006 and 2015. Prior to 2010 the majority of investment took place in the refining sector, but between 2010 and 2014 more was invested in the chemical sector. Capital investment reached a seven-year high of $1.2 billion in 2015: the chemical sector invested $473 million and the refining sector $741 million.

What are the CPR Sector's Main Products?

To come up with a list of the sector's top commodities is challenging as revenue estimates for most commodities are suppressed by Statistics Canada for reasons of confidentiality. Therefore, we will examine a number of sources including export statistics (next section).

Estimates of production volumes of refinery products are available from a monthly survey of refineries. Net production of refinery products in Alberta was about 26 million tonnes in 2015 and Alberta accounted for 24% of Canadian refinery production that year. The largest commodities on a volumetric basis that were produced in Alberta

[3] Estimates from Statistics Canada Table 281-0024 Survey of Employment, Payrolls and Hours (SEPH)

include motor gasoline (9.6 million tonnes), diesel fuel (8.8 million), asphalt (2.2 million) and aviation turbo fuel (1.5 million).

The annual manufacturing survey and the provincial Input-Output tables include sales values for a few of the refinery sector's commodities:

- Gasoline: $7.0 billion in 2013
- Diesel fuel: $7.2 billion in 2013
- Jet fuel (mostly turbo fuel): $957 million in 2014
- Prepared asphalt and tar roofing and siding products: $200 million in 2012

Besides these products Alberta also produces and exports more than $200 million of liquefied butadiene and propylene.

Polyethylene[4] is by far the largest commodity produced in the chemicals sector, both on a volume and value of sales basis. Although estimates of sales of polyethylene are suppressed by Statistics Canada we have estimated that about 90% of the $4.7 billion in sales of the resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing sub-sector in 2015 can be attributed to polyethylene sales. The estimate of $4.3 billion in polyethylene sales is based on polyethylene exports from Alberta totaling $4.0 billion that year, exports accounting for about 85% of Canadian production and Alberta being by far the largest polyethylene producing province. Sales volumes likely totaled between 2.6 and 2.8 million tonnes in 2015.

Other major products produced by Alberta's chemical sector include:

- Fertilizers (mainly ammonia, urea and ammonium nitrate): $1.6 billion in 2013 (ammonia accounts for more than half of fertilizer sales)
- Ethylene glycol: more than $1 billion in sales
- Anhydrous ammonia: close to $1 billion in sales
- Aromatic hydrocarbon gases (mainly styrene): $839 million in 2014
- Liquified refinery gases and acyclic hydrocarbons (such as butene, propene and ethylene): $316 million in 2014
- Argon and nitrogen: $227 million in 2012
- Diethylene Glycol: at least $200 million
- Ethylene vinyl acetate: at least $150 million
- Methanol: more than $100 million
- Bio-diesel: more than $100 million

Markets

Approximately 40% of the CPR sector's output in 2013 was shipped to customers within the province, mainly gasoline, diesel fuel and other refinery products. A further 30% is shipped to customers in other provinces, also mostly refinery products.

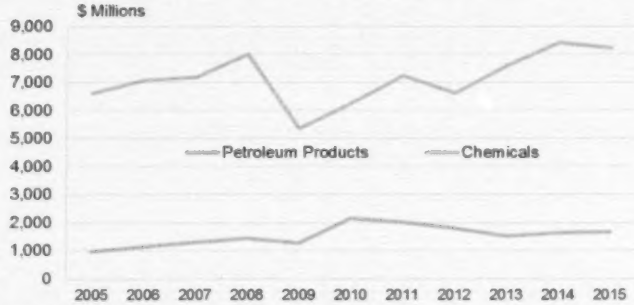
[4] Polyethylene estimates combine low, linear low and high density polyethylene and ethylene polymers

Close to 30% of this sector's production is exported internationally. Although refinery products account for close to two-thirds of this sector's revenues, they account for less than 20% of exports.

Only about 10% of sales by the refining sector are destined for international markets, primarily for the U.S. About one-half of sales stay within the province and 40% gets shipped to other provinces. In the chemicals sector at least 55% of sales are destined for international markets with about 84% of international exports going to the U.S and 10% to China. A further 10% is being shipped inter-provincially and just over 30% is staying within the province.

International exports of the CPR industry rose 30% between 2005 and 2015 to $9.9 billion. They increased sharply between 2005 and 2008 to $9.4 billion, mostly as a result of higher prices. The CPR industry's exports fell by 30% in 2009, as exports to the U.S., which account for more than 80% of Alberta's CPR exports, fell by 32%.

Chart 3
Exports of Chemicals and Refinery Products Remain Strong



Source: Statistics Canada

Exports have recovered strongly since then, growing by one-half between 2009 and 2014 to a record $10.0 billion as the export values of styrene, acyclic hydrocarbons and ethylene glycol doubled. The export value dropped slightly in 2015 to $9.9 billion on lower prices, especially for refinery products such as diesel fuel and other fuel oils.

The following commodities had the highest export sales values in 2015:

- Polyethylene: $4.0 billion in 2015; up 49% from 2005
- Ethylene glycol: $1.3 billion; up 12%
- Anhydrous ammonia: $751 million; up 110%
- Diesel fuel and other heavy fuel oils: $687 million; up 80%
- Saturated acyclic hydrocarbons (such as pentanes, butanes, ethane): $555 million; up 187%
- Gasoline and other light oils: $524 million; up 167%
- Urea: $335 million; down 9%
- Styrene: $270 million; down 46%
- Unsaturated acyclic hydrocarbons (such as acetylene): $201 million; up 65%

The sector's largest international export markets are the U.S., with an 86% export share, followed by China (9%) and Mexico (3%).

What are the largest Inputs of the CPR Sector?

In order to determine the largest inputs on a value basis of the CPR sector we examined the 2013 provincial Input-Output tables.
For the petroleum refineries sub-sector crude oil is by far the largest input, accounting for 70% of the total value of all inputs for this sub-sector in 2013. The next largest inputs are the two largest components of GDP by industry, wages and salaries and corporate profits, which together account for 21% of the total input value. Other major inputs include pipeline transportation services (2%), gas and gas liquids (2%) and chemicals (1%).

For basic chemicals, the largest input is wages and salaries and corporate profits which together accounted for about 45% of the sub-sector's total input value in 2013. Other major inputs include gas and gas liquids (19%), petrochemicals (14%), other chemicals (4%), electricity (2%) and pipeline transportation (2%).

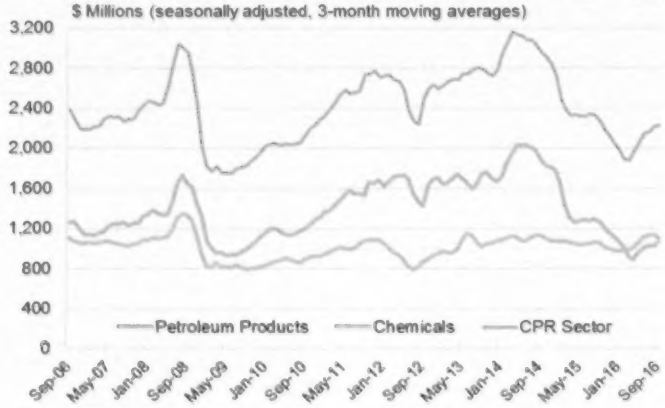
In the synthetic resins sub-sector, petrochemicals (for instance ethylene) are the largest input with a 45% share. Wages and salaries and corporate profits account for 30% of the input value. Other chemicals account for 5% and truck transportation for 2%.

The number one input for the fertilizers and pesticides sub-sector is wages and salaries and corporate profits with a 34% share. Natural gas accounts for about 12% of inputs. Chemicals have a roughly 10% input share, most of that consists of ammonia and industrial gases, and non-metallic minerals account for 8%.

How is the CPR Sector performing in 2016?

After dropping sharply in 2015 this sector's revenues continued to fall through the first quarter of 2016 as lower crude oil prices get reflected in lower prices for such refinery products as gasoline and diesel fuel. However, revenues have increased slightly since then (Chart 4). CPR revenues fell by 10% in the first nine months of this year, compared with the same period of 2015: refined petroleum product sales fell 19% but sales of chemicals increased 2%.

Chart 4
Value of Sales by the Chemicals and Petroleum Refining Industry



Source: Statistics Canada

Exports have fallen about 6% in the chemical sector during the first nine months of this year compared with 2015 and exports of refinery products are about 27% lower this year. Employment levels in the CPR sector have been fairly stable between September 2015 and September 2016.

Major Indicators for the Chemicals and Petroleum Refining Industry					
	2005	2010	2014	2015	% Change 2005-2015
Revenues ($Millions)	25,846	25,514	35,190	26,600	2%
- Petroleum Refining	12,978	14,768	22,630	14,563	12%
- Chemicals	12,868	10,746	12,560	12,037	-6%
GDP (Millions of constant $)	4,564	3,621	3,840	3,878	-15%
- Petroleum Refining	1,920	1,769	1,829	1,739	-9%
- Chemicals	2,644	1,852	2,011	2,138	-19%
Number of companies (with employees)	300	275	286	295	
Number of jobs	11,239	12,936	15,299	16,261	45%
- Petroleum Refining	2,785	6,543	6,449	6,018	116%
- Chemicals	8,454	6,393	8,850	10,243	21%
Capital investment ($Millions)	N/A	546	1,150	1,214	N/A
- Petroleum Refining	N/A	257	534	741	N/A
- Chemicals	N/A	289	616	473	N/A
International exports ($Millions)	7,570	8,397	10,038	9,875	30%
- Petroleum Refining	963	2,152	1,629	1,660	72%
- Chemicals	6,607	6,245	8,409	8,215	24%

Source: Statistics Canada